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1. A belt module, which comprises:

a) an intermediate section having opposed first and second walls, wherein the intermediate section has an intermediate width defined by the first and second walls and a thickness defined by an upper surface and a lower surface and wherein the intermediate section comprises a web portion extending across the intermediate width between the first and second walls and from one of the upper and lower surfaces to a portion of the way though the thickness of the intermediate section to form into a corrugated portion extending across the intermediate width between the first and second walls to the other of the upper and lower surfaces, wherein the corrugated portion has a sinusoidal shape comprising a series of regularly spaced ridges and valleys extending substantially across a lateral width of the module;

b) a first plurality of link ends extending outwardly from the intermediate section including the web portion and being connected to the regularly spaced ridges of the first wall of the corrugated portion;

c) a second plurality of link ends extending outwardly from the intermediate section including the web portion and being connected to the regularly spaced ridges of the second wall of the corrugated portion and in a direction opposite the first link ends; and

d) transverse openings provided in each of the first and second link ends.

2. The belt module of Claim 1, wherein the first and second link ends each have a leg portion connected to the intermediate section including the respective regularly spaced ridges, and

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wherein each leg portion has substantially parallel leg sidewalls.

3. The belt module of Claim 2, wherein the first and second link ends each have a head portion that is wider than the leg portion, the head portion having a pair of substantially parallel head sidewalls and an endwall.

4. The belt module of Claim 3, wherein a junction of the head sidewalls and endwall of the head portion is rounded.

5. The belt module of Claim 4, wherein the endwall of the head portion is rounded and connects a top surface of the link end to a bottom surface of the link end.

6. The belt module of Claim 1, further comprising an opening disposed through the belt module from the upper surface to the lower surface.

7. A radius conveyor belt, comprising:

a) a plurality of belt modules, each having a plurality of first link ends disposed in the direction of belt travel, a plurality of second link ends disposed in the opposite direction, and an intermediate section disposed between and connected to the first and second plurality of link ends, wherein at least some of the modules are provided with the intermediate section having a width defined by the first and second walls and a thickness defined by an upper surface and a lower surface and wherein the intermediate section comprises a web portion extending across the intermediate width between the first and second walls and from one of the upper and lower surfaces to a portion of the way through the thickness of the intermediate section to form into a corrugated portion extending across the intermediate width

between the first and second walls to the other of the upper and lower surfaces, wherein the corrugated portion has a sinusoidal shape comprising a series of regularly spaced ridges and valleys extending substantially across a lateral width of the module;

b) a first plurality of link ends extending outwardly from the intermediate section including the web portion and being connected to the regularly spaced ridges of the first wall of the corrugated portion;

c) a second plurality of link ends extending outwardly from the intermediate section including the web portion and being connected to the regularly spaced ridges of the second wall of the corrugated portion and in a direction opposite the first link ends, the plurality of first and second link ends being disposed such that a space capable of receiving a link end is formed between each adjacent link end, the space being open at one end and terminating in a rounded region at the opposite end, the plurality of first link ends being offset from the plurality of second link ends such that the first link ends align with the space between the second link ends such that adjacently positioned belt modules are capable of intercalating so that the first link ends of one belt module fit into the spaces defined between the second link ends of an adjacent belt module, wherein the plurality of first link ends each have a transverse slotted opening disposed transverse to the direction of belt travel and extending in the direction of belt travel, the plurality of second link ends having a transverse opening defined therein; and

d) a pivot rod extending transverse to the direction of belt travel through the openings in the second link ends of one of the plurality of belt modules and extending through the slotted openings in the first link ends of an adjacent belt module such that the first and second link ends of the adjacent belt modules are intercalated and the adjacent belt modules are

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interlinked into adjacent hinged rows capable of following a curved path.

8. The radius conveyor belt of Claim 7, wherein the first and second link ends each have a leg portion connected to the intermediate section including the respective regularly spaced ridges, and wherein each leg portion has substantially parallel leg sidewalls.

9. The radius conveyor belt of Claim 8, wherein the first and second link ends each have a head portion that is wider than the leg portion, the head portion having a pair of substantially parallel head sidewalls and an endwall.

10. The radius conveyor belt of Claim 9, wherein a junction of the head sidewalls and endwall of the head portion is rounded.

11. The radius conveyor belt of Claim 9, wherein the endwall of the head portion is rounded and connects a top surface of the link end to a bottom surface of the link end.

12. The radius conveyor belt of Claim 7, further comprising an opening disposed through the belt module from the upper surface to the lower surface.

13. The radius conveyor belt of Claim 7, wherein the web and the corrugated portion form a multilevel surface defining the end of the space between adjacent link ends.

14. A conveying system, comprising:

a) an endless radius conveyor belt, comprising a plurality of belt modules, each having a plurality of first link ends disposed in the direction of belt travel and provided with a

first rounded endwall, a plurality of second link ends disposed in the opposite direction and provided with a second rounded endwall, and an intermediate section disposed between and connected to the first and second plurality of link ends, wherein at least some of the modules are provided with the intermediate section having an intermediate width defined by the first and second walls and a thickness defined by an upper surface and a lower surface, and wherein the intermediate section comprises a web portion extending across the intermediate width from the first wall to the second wall and from one of the upper and lower surfaces to a portion of the way through the thickness of the intermediate section to form into a corrugated portion extending across the intermediate width from the first wall to the second wall to the other of the upper and lower surfaces, wherein the corrugated portion has a sinusoidal shape comprising a series of regularly spaced ridges and valleys extending substantially across a lateral width of the module;

b) a first plurality of link ends extending outwardly from the intermediate section including the web portion and being connected to the regularly spaced ridges of the first wall of the corrugated portion;

c) a second plurality of link ends extending outwardly from the intermediate section including the web portion and being connected to the regularly spaced ridges of the second wall of the corrugated portion and in a direction opposite the first link ends, the first and second link ends disposed such that a space capable of receiving a link end is formed between each adjacent link end, the space being open at one end and terminating in a rounded region at the opposite end, the plurality of first link ends being offset from the plurality of second link ends such that the first link ends align with the space between the second link ends such that adjacently positioned belt modules are capable of intercalating so that the first link ends of one belt

module fit into the spaces defined between the second link ends of an adjacent belt module, wherein the plurality of first link ends each have a transverse slotted opening disposed transverse to the direction of belt travel and extending in the direction of belt travel, and wherein the plurality of second link ends have a transverse opening defined therein;

d) a pivot rod extending transverse to the direction of belt travel through the openings in the second link ends of one of the plurality of belt modules and extending through the slotted openings in the first link ends of an adjacent belt module such that the first and second link ends of the adjacent belt modules are intercalated and the adjacent belt modules are interlinked into adjacent hinged rows capable of following a curved path;

e) at least one middle belt module disposed in an interior position of the conveyor belt and comprising the intermediate section having an angled face; and

f) a drive sprocket having teeth disposed around the perimeter thereof, the teeth capable of engaging with the first and second rounded endwalls of the link ends and capable of engaging with the angled face on the intermediate section of the middle belt module to drive the endless conveyor belt around a conveying path.

15. The conveying system of Claim 14, wherein the first and second link ends each have a leg portion connected to the intermediate section including the respective regularly spaced ridges, and wherein each leg portion has substantially parallel leg sidewalls.

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16. The conveying system of Claim 15, wherein the first and second link ends each have a head portion that is wider than the leg portion, the head portion having a pair of substantially parallel head sidewalls and an endwall.

17. The conveying system of Claim 16, wherein a junction of the head sidewalls and endwall of the head portion is rounded.

18. The conveying system of Claim 16, wherein the endwall of the head portion is rounded and connects a top surface of the link end to a bottom surface of the link end.

19. The conveying system of Claim 14, further comprising an opening disposed through the belt module from the upper surface to the lower surface.

20. The conveying system of Claim 14, wherein the web and the corrugated portion form a multilevel surface defining the end of the space between adjacent link ends.

21. The belt module of Claim 1 wherein at least the opening in one of the first and second plurality of link ends is elongated in a direction along an axis of the link end extending from the intermediate section.

22. The belt module of Claim 1 wherein a first longitudinal axis of the transverse openings in the first link ends and a second longitudinal axis of the transverse openings in the second link ends are positioned substantially equidistant from the upper and lower surface of the intermediate section.

23. The belt module of Claim 1 wherein a first longitudinal axis of the transverse openings in the first link ends and a second longitudinal axis of the transverse openings in the second link ends are spaced closer to the lower surface of the intermediate section than to the upper surface thereof.

24. The radius conveyor belt of Claim 7 wherein the web portion of a first module is capable of hooding the link ends of a second module intercalated with the first module.

25. A belt module, which comprises:

a) an intermediate section having opposed first and second walls, wherein the intermediate section has an intermediate width defined by the first and second walls and a thickness defined by an upper surface and a lower surface and wherein the intermediate section comprises a web portion extending across the intermediate width from the first wall to the second wall and from one of the upper and lower surfaces to a portion of the way though the thickness of the intermediate section to form into a corrugated portion extending across the intermediate width from the first wall to the second wall to the other of the upper and lower surfaces, wherein the corrugated portion has a sinusoidal shape comprising a series of regularly spaced ridges and valleys extending substantially across a lateral width of the module;

b) a first plurality of link ends extending outwardly from at least the regularly spaced ridges of the first wall of the corrugated portion;

c) a second plurality of link ends extending outwardly from at least the regularly spaced ridges of the second wall of the corrugated portion and in a direction opposite the first link ends; and

d) transverse openings provided in each of the first and second link ends.

23. The belt module of Claim 1 wherein a first longitudinal axis of the transverse openings in the first link ends and a second longitudinal axis of the transverse openings in the second link ends are spaced closer to the lower surface of the intermediate section than to the upper surface thereof.

24. The radius conveyor belt of Claim 7 wherein the web portion of a first module is capable of hooding the link ends of a second module intercalated with the first module.

25. A belt module, which comprises:

a) an intermediate section having opposed first and second walls, wherein the intermediate section has an intermediate width defined by the first and second walls and a thickness defined by an upper surface and a lower surface and wherein the intermediate section comprises a web portion extending across the intermediate width from the first wall to the second wall and from one of the upper and lower surfaces to a portion of the way though the thickness of the intermediate section to form into a corrugated portion extending across the intermediate width from the first wall to the second wall to the other of the upper and lower surfaces, wherein the corrugated portion has a sinusoidal shape comprising a series of regularly spaced ridges and valleys extending substantially across a lateral width of the module;

b) a first plurality of link ends extending outwardly from at least the regularly spaced ridges of the first wall of the corrugated portion;

c) a second plurality of link ends extending outwardly from at least the regularly spaced ridges of the second wall of the corrugated portion and in a direction opposite the first link ends; and

d) transverse openings provided in each of the first and second link ends.

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module of the present invention;

Fig. 8 is a top plan view of an alternate embodiment of a belt module suitable for use in the middle of a bricklayed modular radius conveyor belt according to the present invention;

Fig. 9 is a bottom plan view of the belt module of Fig. 8;

Fig. 10 is an end elevational view of the belt module of Fig. 8;

Fig. 11 is a section view taken along lines 11-11 of Fig. 8;

Fig. 12 is a top plan view of an alternate embodiment of the belt module of the present invention;

Fig. 13 is a sectional view taken along lines 13-13 of Fig. 12;

Fig. 14 is a side elevation view of a drive sprocket engaging the radius conveyor belt of the present invention; and,

Fig. 15 is a cutaway side elevation view of a drive sprocket engaging with the link end and center cross-rib of the mid modules of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, Figs. 1 to 7 show a first embodiment of a portion of a modular belt 20 of the present invention. The portion of the modular belt 20 shown is formed from molded plastic modules 23, 26 and 29. For reference, the direction of belt travel is indicated by arrow 32, however, the belt of the present invention may be conveyed in either direction. A pivot rod 35 connects adjacent belt modules by passing through openings in the modules disposed transverse to the direction of belt travel.

As shown in Fig. 2, an exemplary one of the belt modules 26 has an intermediate section 38 supporting a plurality of first link ends 41 and a plurality of

the head portion 65 is connected to the leg portion 59 by the angled intermediate section 62. The head portion 65 is preferably formed with two substantially parallel sides 98 and 101 connected by an outer end 104. The corners between the sides 98, 101 and ends 104 are preferably radiused to be smooth and to protect the conveyed product from damage.

An opening 107 is defined between spaced apart sides 110, 113 of adjacent link ends. At a distal end 116, the ends of adjacent links form the mouth 119 of the opening 107. At the opposite end 122, the opening 107 terminates in the multi-level surface defined by the web 47 and corrugated portion 50 as described above. The top level of the surface (best shown in Fig. 1) is defined by wall 89 of the web 47. The corners where the side walls of the link ends 41 meet the straight wall 89 of web 47 are also radiused to be smooth and to protect the conveyed product from damage.

In Fig. 5, the bottom level of the surface is defined by the relatively thin corrugated portion 50 having a pair of essentially parallel walls 125, 128. The corrugated portion 50 forms the series of regularly spaced alternating ridges 53 and valleys 56 along the intermediate section 38, as described herein.

Returning to Fig. 2, the straight wall 89 is shown bordering the opening 107. The curved surface defined by corrugated portion 50 is shown in broken lines. The curved surface receives link ends from an adjacent belt module such that the belt 20 is capable of collapsing for movement around a curved path, as described in detail herein.

The plurality of second link ends 44 extend from the belt module 26 in the opposite direction from the first link ends 41. The second link ends 44 have the same overall shape as the first link ends 41 (except for the last link end 45) and are designed to fit into the

The outer ends 104 of the link ends 41 and 44 are radiused in a smooth rounded surface 146. The rounded surface 146 preferably comprises a rounded surface having a constant radius and provides a driving surface for engagement with the drive sprocket 149, as described herein.

Also, the curvature of the outer ends 104 of the link ends enables the links to clear the web 47 when the adjacent modules collapse along the edge. The clearance enables the link ends to extend under the web 47 into the space defined by the corrugated portion 50 (best shown in Figs. 6-7). In this manner, the web 47 partially hoods the link ends when the belt 20 collapses. Accordingly, the belt module 26 provides a web 47 for structural stability while maintaining a corrugated portion 50 to allow for recesses that provide maximum space for collapsing the belt modules around a curved path.

Turning to Figs. 8-11, an alternate embodiment comprising belt module 200 is shown. Belt module 200 is suitable for center modules in a bricklayed belt.

The belt module 200 includes link ends 206, 207 which are supported by an intermediate section 208. The link ends 206 have a slot 209 disposed transverse to the direction of belt travel indicated by arrow 211. Link ends 207 have a transverse opening 213 that corresponds to the shaft 138 of pivot rod 35.

As shown in Fig. 9, the belt module 200 has a web 212 that is part of the intermediate section 208 and that is wider than the corrugated portion 50 of the edge module 26 shown in Figs. 1-7 (best shown in Fig. 5). In Fig. 8, the opening 218 between the link ends 206 is defined by a mouth 221 at one end 224 and is defined at the opposite end 227 by a multilevel surface defined by the web 212 and by a straight wall portion 230 that joins with the link end in a curved section 233.

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As shown in Figs. 10 and 11, the bottom of the intermediate section 208 of the link ends is angled to provide a face 236 for engagement of the intermediate section 208 with the teeth 148 on the drive sprocket 149 (Fig. 14). The drive sprocket 149 is described in detail hereafter.

The link ends 207 have the transverse opening 213 capable of receiving the pivot rod 35. Link ends 206 have the transverse slot 209 that is oblong and extends in the direction of belt travel such that the pivot rod 35 can move inside the slot 209 to pivot and facilitate collapsing.

The engagement of the face 236 on the central portion 215 with the tooth 148 on the drive sprocket 149 (shown in Fig. 15) assists in maintaining engagement between the belt 20 and the drive sprocket 149 and assists in driving the belt 20. The primary drive mechanism is described in detail below.

Turning to Figs. 12-13, belt module 300 is an alternate embodiment of belt modules 23, 26, 29 of Figs. 1-7. Belt module 300 differs from the previous modules because the slot and the holes are positioned off center on the link ends 303 and 306, respectively. The transverse slot 309 and transverse openings 312 are located lower on the belt module 300 which provides for increased module strength. The distance 315 from the top surface 318 to the center 321 of the opening 312 is greater than the distance 316 from the center 321 of the opening 312 to the bottom surface 324. Also, the link end 303 with the transverse slot 309 is designed such that the radius of curvature at the rounded end is greater above the slot 309 than it is below the slot 309.

As an option, the belt module 300 includes a plurality of openings 331 that provide for reducing the weight and material cost for the belt and provide open

areas for cleaning the belt. The vertical openings 331 in the link ends 306 are shown in Figs. 12 and 13.

Turning to Figs. 14 and 15, the belt modules 20 (Figures 1-7) are shown driven by the teeth 148 on the drive sprocket 149. The drive sprocket 149 is center driven by a rotating shaft (not shown) as known to those of ordinary skill in the art. The teeth 148 engage with the rounded surface 146 on the outside of the link ends and push the link ends forward. In addition to the engagement of the teeth on the rounded surface 146 of the link ends, the central portions 215 (Fig. 15) of the middle modules push against the teeth along the angled face 236.

While the invention has been described in connection with certain preferred embodiments, it is not intended to limit the scope of the invention to the particular forms set forth, but, on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.